ARC TYPE BTK-21

BENCH TEST KIT

AIRCRAFT RADIO CORPORATION BOONTON, NEW JERSEY

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ARC reserves the right to make changes in design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

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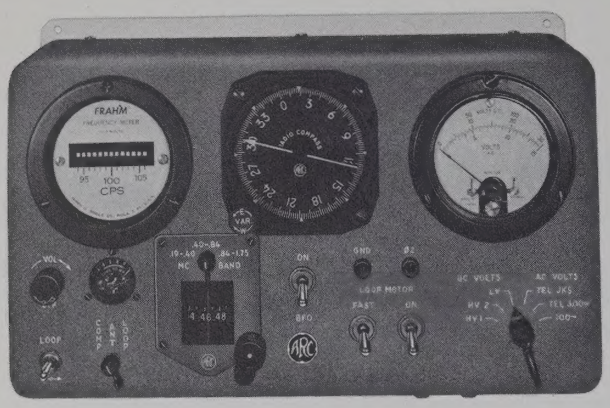

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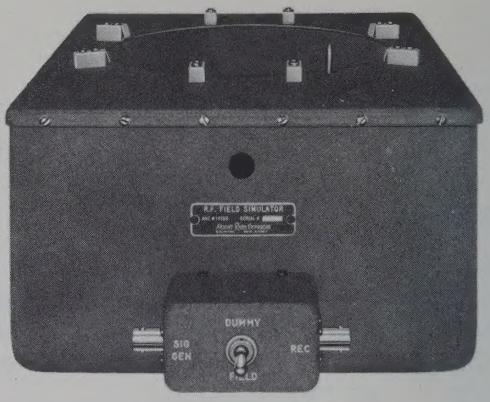

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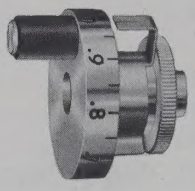

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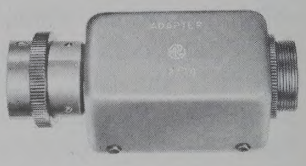

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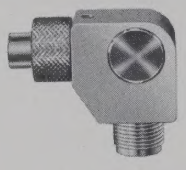

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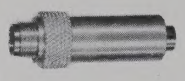

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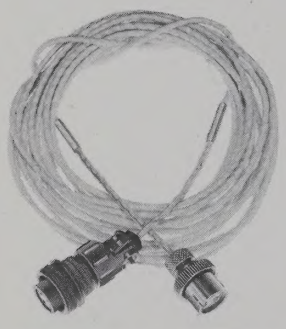

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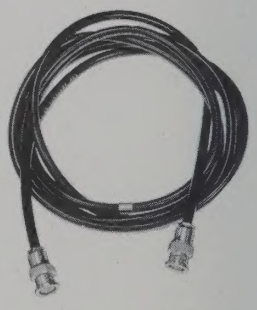

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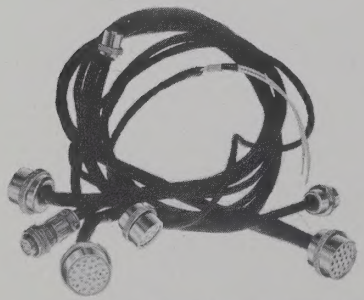

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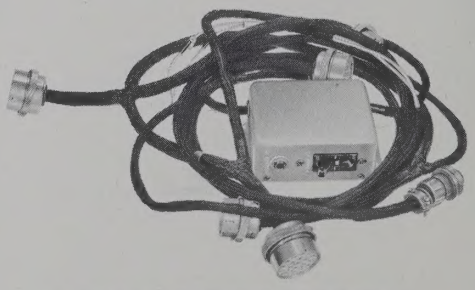

CABLE HARNESS ASSEMBLY
ARC-23042

Figure 1. ARC Type BTK-21 Bench Test Kit

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SECTION I
GENERAL INFORMATION

1–1. PURPOSE.

The ARC Type BTK-21 Bench Test Kit (Figure 1–1) is designed to test any component of the ARC Type 21 or ARC Type 21A Automatic Direction Finder. When the BTK-21 is used with an ARC Type R-30 or R-30A Receiver, an ARC Type P-14 or P-14A Power Unit, an ARC Type L-11 Loop, and a properly rated low-voltage primary power supply, a complete operating ADF system is available for bench installation. In addition to component testing, loop compensation may be measured, or a specific loop-compensation schedule set up. The BTK-21, with the ADF components listed previously, simulates an ADF system with a top-mounted sense antenna and loop.

1–2. COMPONENTS SUPPLIED.

The following components are supplied as part of the ARC Type BTK-21 Bench Test Kit:

Qty	Name	ARC Part No.
1	ADF Test Panel	19770
1	RF Field Simulator	19780
1	Loop Cable Coupler	19760
1	Loop Cable Assembly	17985
1	Sense Antenna Cable Assembly	17984(7 ft)
1	Cable Harness Assembly	23042
1	Cable Harness Assembly [1]	19790
1	Adapter Assembly [2]	22770
1	Mechanical Linkage	16158(5 ft)
1	Knob	18802
1	Shaft Extension	21330
1	Coupling, Right-angle	6357
1	Instruction Book	—

[1] Cable Harness Assembly ARC-19790 is an alternative for Cable Harness Assembly ARC-23042. Refer to paragraph 1–4.
[2] Available on special order. To be used with Cable Harness Assembly ARC-19790 to test ARC Type IN-13A Indicator.

1–3. AUXILIARY COMPONENTS.

The following components are required to complete the ADF test system:

Qty	Name	ARC Part No.
1	Receiver ARC Type R-30 or Receiver ARC Type R-30A	17960 20480
1	Power Unit ARC Type P-14 or Power Unit ARC Type P-14A	18020 20490
1	Loop ARC Type L-11	18000
1	Power Supply, 14 or 28 volts dc, as required	—

1–4. DESCRIPTION.

ADF Test Panel. The ADF test panel is the "control center" of the BTK-21. It duplicates the electrical and mechanical functions of the ARC Type C-59 and C-59A Control Units. It also includes additional items required to test completely the Type 21 and 21A.

All of the ADF test panel parts are installed on an aluminum chassis approximately 7⅞ by 12½ by 5⅝ inches, overall. The unit is intended for wall-mounting by means of its extended rear cover plate. In this position, all the operating controls and instruments are readily accessible and visible, and all cable connections may be routed to keep the bench-test area relatively clear.

RF Field Simulator. When energized by a suitable signal generator, the RF field simulator is designed to produce simultaneously an r-f field suitable for energizing the loop and a proportionate signal for the sense antenna input of the receiver. It will also simulate a sense antenna alone. Under the first condition (FIELD position of the DUMMY-FIELD switch), a sense antenna having an effective height of ¼-meter and a capacity of 50 $\mu\mu$f is simulated. The microvolt reading of a low-output-impedance signal generator is numerically equal to the field strength in microvolts/meter at the loop. Under the second condition (DUMMY position), the simulated sense antenna is also 50 $\mu\mu$f and ¼-meter effective height, and the signal generator dial is a direct-reading of the simulated microvolts picked up by such an antenna. The RF field simulator consists of a main chassis, with a screw-attached cover, and two subchassis attached to opposite ends of the main chassis. The overall size of the unit is approximately 15 by 9½ by 5½ inches. The cover, which forms the top of the main chassis, has a circular cut-out, and is fitted with a locating pin and brackets for positioning and mounting the loop. The field-generating wire is suspended within the main chassis, between the two subchassis which contain the remainder of the circuit. One of the subchassis includes two BNC type UG-290A/U connectors and a dpdt toggle switch. The BNC connectors are used for the signal generator input and the receiver sense antenna

cable. The toggle switch is used to select the desired antenna simulation. The other subchassis contains a terminating resistor.

Loop Cable Coupler. The loop cable coupler is designed to compensate for the slight reduction in loop inductance which occurs when the loop is installed in the RF field simulator. The change in inductance is due to the coupling between the simulator chassis and the loop. To restore the inductance, which is necessary for proper tuning and tracking of the receiver, the loop cable coupler is connected between the loop cable and the loop. When connected, the loop cable coupler inserts a small inductance in series with each side of the balanced loop and restores the total inductance of the circuit to the nominal value.

The circuit of the loop cable coupler is installed in an aluminum box approximately 4¼ by 1¾ by 1⅝ inches, overall. The box is terminated on one end with an ARC-18016 connector for the loop cable connection and on the other end with an ARC-18026 connector for direct connection to the loop.

Loop Cable Assembly. The loop cable assembly is a specially designed, three-conductor, shielded cable, approximately 20 feet long, terminated at one end with an ARC-14599 connector and clamp and on the other end with an ARC-12371 connector. The loop cable assembly is used to interconnect the loop cable coupler and the receiver. The cable itself is designed to have special electrical characteristics and therefore different samples may vary slightly in length. Its length must not be altered since it is used as part of the tuned loop circuit. Its effective capacity is 350($\pm$5) $\mu\mu$f and its inductance is 4.5 μh.

Sense Antenna Cable Assembly. The sense antenna cable assembly is a 7-foot length of RG-62/U coaxial cable terminated at each end with a UG-260/U connector. In its finished length, the cable assembly has a capacitance of 100($\pm$5) $\mu\mu$f. Because of this characteristic, the length of the cable should not be altered. The cable assembly is used to interconnect the RF field simulator and the receiver.

Cable Harness Assembly ARC-23042. This cable harness assembly is used to connect the primary power source, and to interconnect the bench test units and ADF Equipment using an ARC Type IN-12 or IN-13A Indicator. The cable harness consists of a switch assembly and suitable wire lengths terminated in seven plug-type connectors. The switch assembly provides circuit protection by connecting a 20-ampere circuit breaker in series with the primary power connecting leads. A telephone jack for monitoring current flow is also contained in the switch assembly. The circuit breaker, telephone jack, and associated wiring are housed in an aluminum box approximately 4 by 3⅛ by 1⅝ inches, overall. A mounting plate attached to one side of the switch assembly provides four drilled holes for bench mounting.

Cable Harness Assembly ARC-19790. This cable harness assembly is an alternative for Cable Harness Assembly ARC-23042. It is used to connect the primary power source, and to interconnect the bench test units and ADF Equipment using an IN-12 or IN-13 Indicator. The cable harness consists of suitable wire lengths terminated in seven plug-type connectors and two bare, tinned leads; the tinned leads are used to connect the primary power source.

Mechanical Linkage. Mechanical Linkage ARC-16158 is a 5-foot length of flexible shafting enclosed in a metal casing used for remote-control tuning of the receiver. In the event remote tuning is not desired, Knob ARC-18802 may be used with Shaft Extension ARC-21330 to tune the receiver directly.

Knob. Knob ARC-18802 is designed to be used with Shaft Extension ARC-21330 in place of Mechanical Linkage ARC-16158 for direct tuning of the receiver. It consists of a crank-handle with graduated dial coupled to a spline gear, and an adjustable fiducial mark. The dial graduations are used as a reference for counting the number of dial-turns with relation to the tuning-capacitor frequency setting. The spline of the knob mates with the shaft extension which, in turn, mates directly with the receiver tuning-capacitor spline.

Shaft Extension. Shaft Extension ARC-21330 is used to extend the tuning-capacitor shaft of the receiver. With this extension, Knob ARC-18802 can be used to tune the receiver, or a right-angle coupling can be used with the mechanical linkage.

Coupling. Coupling ARC-6357 is a right-angle adapter. It is used to connect Mechanical Linkage ARC-16158 to the receiver where the available space does not allow for a minimum bend-radius of 5 inches. In some instances, Shaft Extension ARC-21330 must be used with the coupling.

Adapter Assembly. Adapter Assembly ARC-22770 is available on special order. This adapter is designed to be used with Cable Harness Assembly ARC-19790 to test an IN-13A Indicator. The adapter consists of an aluminum box terminated on one end with an ARC-12355 connector for cable harness connection, and on the other end with a modified ARC-16729 connector for direct attachment to the indicator. Connections in the adapter assembly provide a common ground terminal for the synchro receivers contained in the indicator. This common ground replaces the individual ground connections used to isolate the synchro circuits in aircraft installations.

SECTION II
INSTALLATION

2–1. INSTALLATION CONSIDERATIONS.

The components of the ARC Type BTK-21 Bench Test Kit may be installed in any desired arrangement. The relative positions are governed only by the lengths of the interconnecting cables and mechanical linkage. It is recommended that the ADF test panel be wall-mounted and the switch assembly of Cable Harness Assembly ARC-23042 (if used) be bench-mounted adjacent to the primary power source. Associated test equipment and the ADF components under test may be placed as desired in the test area.

Though no special installation procedures are required, the following recommendations will insure a stable and noise-free test position:

a. To minimize noise pickup when the receiver is operated without its cover, install the P-14 (or P-14A) Power Unit at least 6 inches from the receiver.

b. To prevent the introduction of noise at the low end of the low-frequency band, install the RF field simulator at least 6 inches from the power unit.

c. If necessary, the RF field simulator should be isolated from the test signal generator to prevent the pickup of any spurious signals. Generally, this can be accomplished by separating the two units by several feet.

d. If desired, Mounting ARC Type M-26 or M-26A for the receiver, and Mounting ARC Type M-28 or M-28A for the power unit, may be procured and attached to the test bench for a shockproof and permanent test position.

2–2. PREPARATION FOR USE.

Intercabling diagrams for the BTK-21 and associated components are shown in Figures 2–1 and 2–2. When using Cable Harness Assembly ARC-19790, use Figure 2–2 and omit Step 5 of the following procedure. When using Cable Harness Assembly ARC-23042, use Figure 2–1 and omit Step 4 of the following procedure. Prepare the test set-up as follows:

Step 1. Install the loop in the RF field simulator.

Step 2. Install the receiver and power unit on their respective mountings (if used).

Step 3. Connect the loop cable coupler to the proper loop connector.

Step 4. Connect the cable harness assembly (see Figure 2–1). All connectors are plainly marked for identification. The low-voltage leads have polarity identification tags attached. P4 of the cable harness assembly is used only for testing an IN-13 or IN-13A Indicator. When testing an IN-13, connect P4 directly to the indicator. When testing an IN-13A, connect P4 to Adapter Assembly ARC-22770 and then connect the adapter assembly to the indicator.

Step 5. Connect the cable harness assembly (see Figure 2–2). All connectors are plainly marked for identification. The low-voltage leads have polarity identification tags attached.

Step 6. Connect the loop cable assembly between the receiver and the loop cable coupler.

Step 7. Connect the sense antenna cable assembly between the receiver and the REC connector of the RF field simulator.

Step 8. Connect the test signal generator to the SIG GEN connector of the RF field simulator.

Step 9. Connect Mechanical Linkage ARC-16158 between the ADF test panel and the receiver. (If Knob ARC-18802 is used, refer to Step 10.) The radius of a bend in the mechanical linkage must not be less than 5 inches, and preferably, only one such bend should be permitted. If the bend radius must be less, connect Right-angle Coupling ARC-6357 between the connecting point and the mechanical linkage. In some instances, Shaft Extension ARC-21330 will be required between the receiver and the coupling. Turn the ADF test panel tuning crank counterclockwise as far as it will go. Disconnect the mechanical linkage at either end. Turn the tuning crank until the reference line just to the right of the high-frequency end of the frequency dial is aligned with the fiducial line. Reconnect the mechanical linkage, being careful not to disturb the setting of the receiver's tuning capacitor or the frequency dial.

Step 10. If Knob ARC-18802 is used for direct-tuning of the receiver, install and align the knob for correct frequency indication as follows: Fit Shaft Extension ARC-21330 over the splined shaft of the receiver main tuning capacitor and tighten. Fit the knob over the splined shaft of the extension and tighten the knurled nut on the knob. Turn the knob tuning crank counterclockwise until it stops—do not force it beyond the stop point. Without disturbing the receiver capacitor setting, loosen the knurled nut and remove the knob. Orient the knob until the red zero line is approximately on top (12 o'clock position). Replace the knob, retain the crank so that the red zero line is still on top and the tuning capacitor does not change position, then retighten the knurled nut. Rotate the collar on the knob until the black fiducial line is aligned with the red zero line.

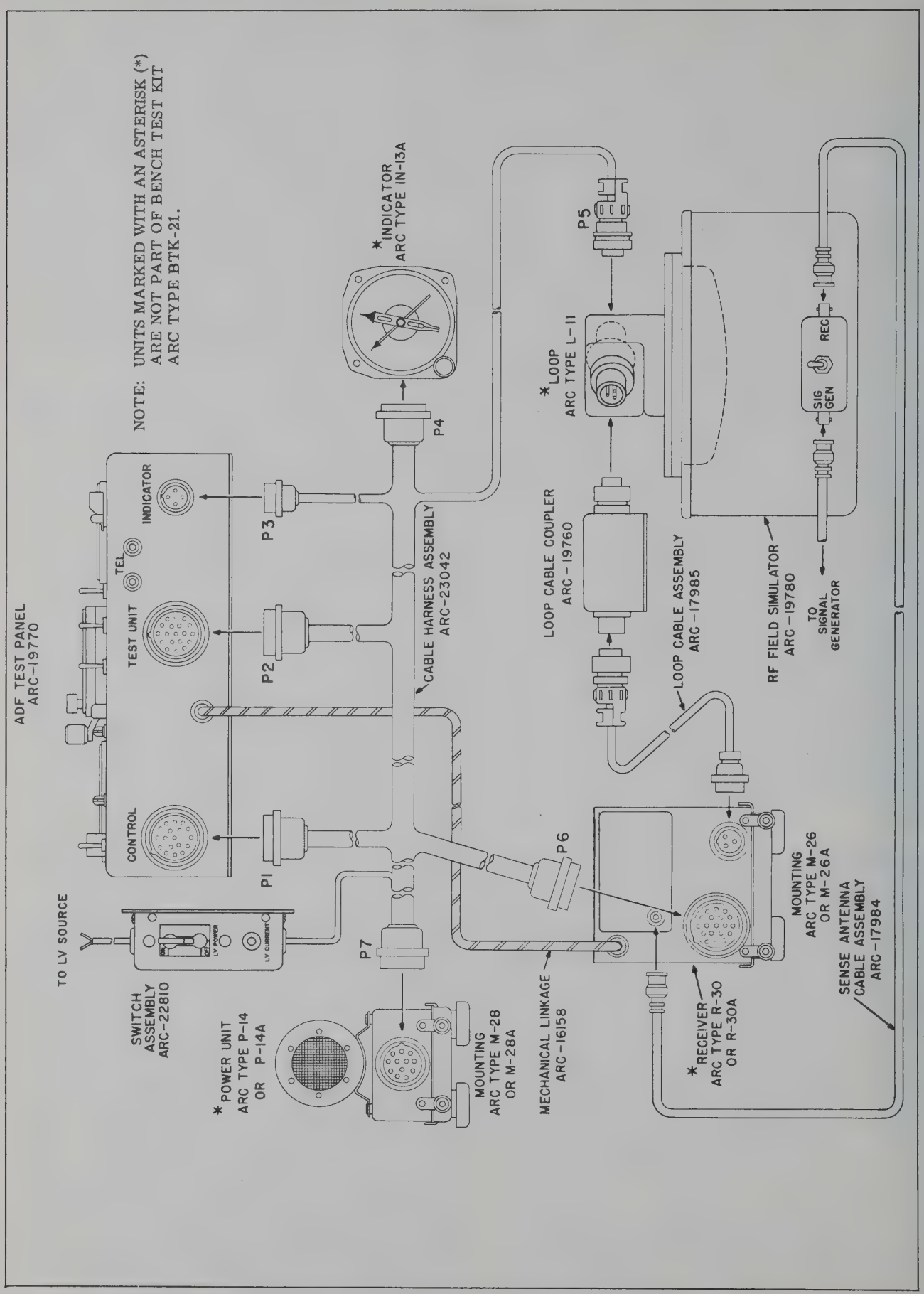

Figure 2–1. Bench Test Intercabling Diagram Using Cable Harness Assembly ARC-23042

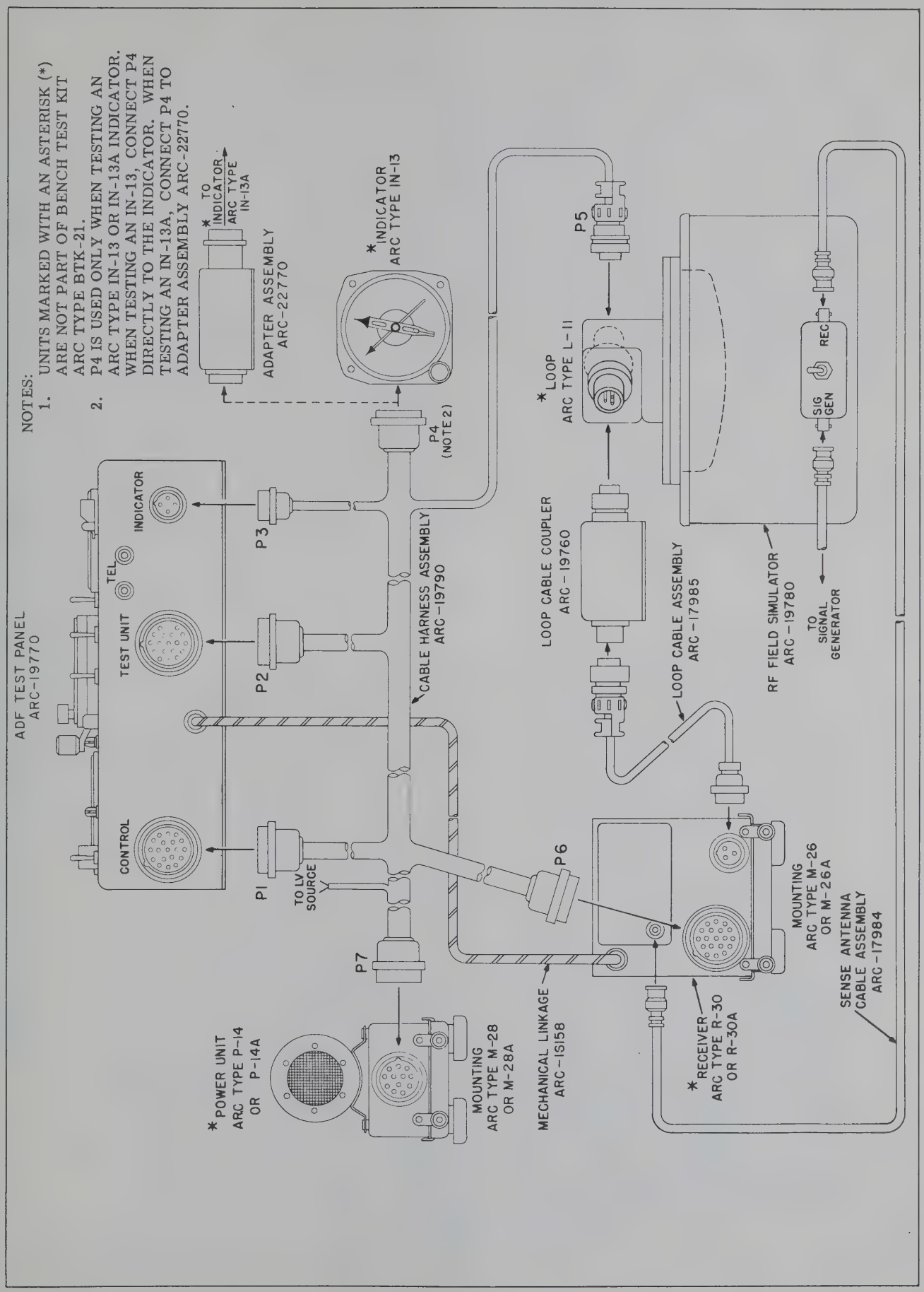

Figure 2–2. Bench Test Intercabling Diagram Using Cable Harness Assembly ARC-19790

SECTION III
OPERATION

3–1. OPERATING PRECAUTIONS.

The receivers, power units, and control units of Type 21 and Type 21A are manufactured for either 14- or 28-volt operation. The ARC Type BTK-21 Bench Test Kit may be used for testing both 14- and 28-volt ADF systems. The voltage rating of the receiver and power unit must be the same. The voltage rating of the control unit is immaterial since no voltage is supplied to the lamps.

Normally, an R-30 Receiver should be used with a P-14 Power Unit, and an R-30A Receiver should be used with a P-14A Power Unit. It is permissible, however, to interchange these components as follows: The R-30 may be used with a P-14A. The R-30A may be used with a P-14, but unless P5 of the cable harness assembly is disconnected during certain loop-function tests, the loop may wander.

The C-59 Control Unit should be tested only with an R-30 Receiver and P-14 Power Unit. Tests of the C-59A require an R-30A and a P-14A.

3–2. OPERATING CONTROLS.

Except for a switch, a circuit breaker,[1] and one test jack,[1] all controls, instruments, and test jacks are located on the ADF test panel. The switch is located on the RF field simulator. The circuit breaker and test jack are located on the switch assembly of Cable Harness Assembly ARC-23042.

All controls and the tuning meter of the ADF control unit are duplicated on the ADF test panel. These items are identified by similar panel markings and serve identical functions (see Figure 3–1). The function of the other test items on the ADF test panel, the RF field simulator (see Figure 3–2), and switch assembly of Cable Harness Assembly ARC-23042 (see Figure 3–3) are as follows:

Panel Designation	*Function*
FREQUENCY METER (No panel marking)	Indicates frequency, in cps, of the nominal 100-cps output of the power unit.
INDICATOR (No panel marking)	ADF indicator. Similar to ARC Type IN-12 Indicator.
VOLTMETER (No panel marking)	For various a-c and d-c test voltage measurements (see METER SWITCH).
METER SWITCH (No panel marking)	Provides for the following a-c and d-c voltage tests, as read on VOLTMETER: *a.* In HV1 position, 125-volt dc output of power unit *b.* In HV2 position, 110-volt dc output of power unit *c.* In LV position, primary voltage *d.* In TEL JKS position, receiver audio ouput across TEL jacks *e.* In TEL 300ω position, receiver audio output across 300 ohms (TEL jacks are automatically disconnected) *f.* In 100~ position, 100-cps voltage output of power unit.
GND and Ø2	For measuring 100-cps amplifier output, which supplies Ø2 (phase 2) of loop motor, with external a-c voltmeter.
LOOP MOTOR	ON-OFF switch connects or disconnects loop motor. FAST-SLOW switch provides two loop motor speeds. In FAST position, speed is normal. SLOW position is provided to permit accurate setting of loop for compensation purposes, or when decreased speed is desired.
TEL	For headset connection, or external a-c voltmeter connection for measuring receiver audio output.
DUMMY-FIELD (on RF field simulator)	FIELD position provides an r-f field to energize the loop and a sense antenna input signal for receiver. In DUMMY position, the loop is deenergized and only the sense antenna is simulated.
LV CURRENT (on switch assembly of Cable Harness Assembly ARC-23042)	For monitoring current from primary power source with external ammeter.
LV POWER (on switch assembly of Cable Harness Assembly ARC-23042)	Interrupts the low-voltage circuit if the current amplitude exceeds 20 amperes. Provides on-off switch external to equipment under test.

[1] Included when Cable Harness Assembly ARC-23042 is used.

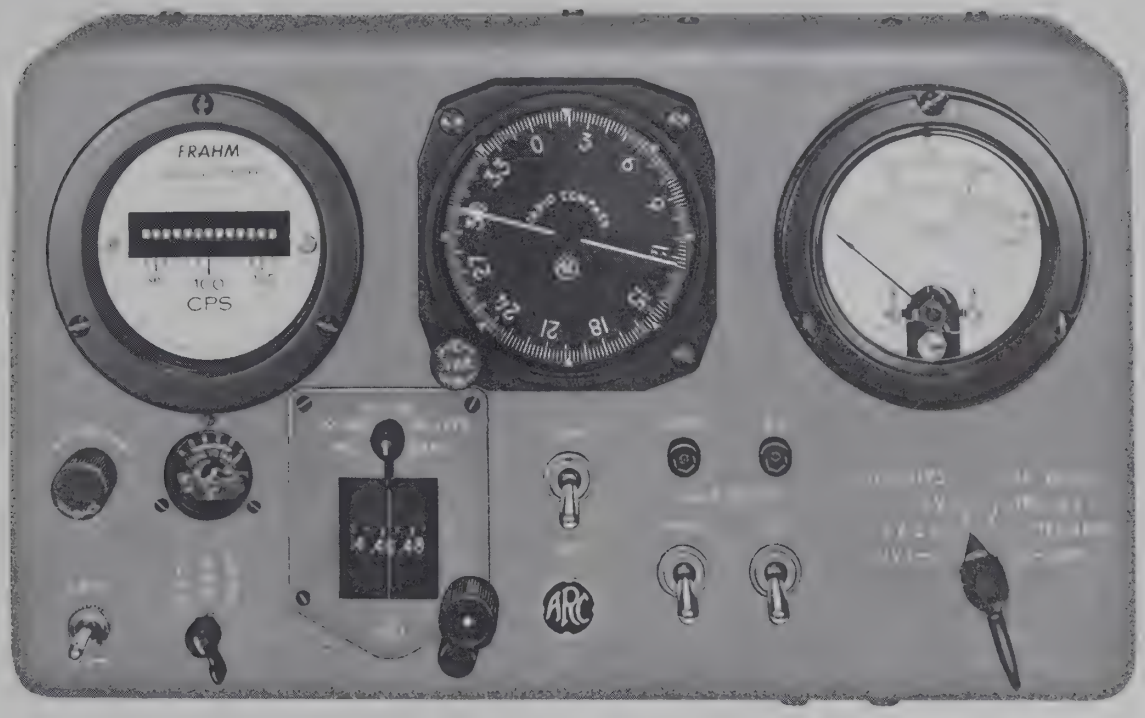

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Figure 3–1. ADF Test Panel, Front Panel View

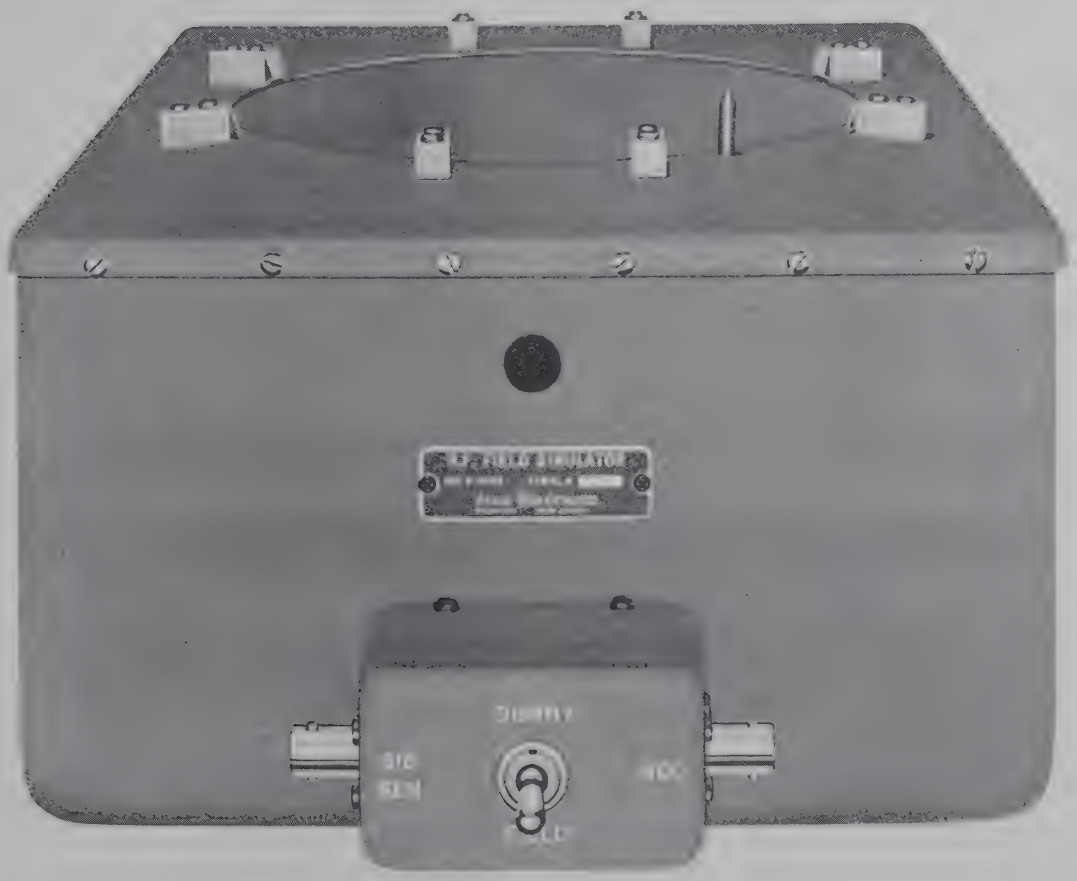

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Figure 3–2. RF Field Simulator

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Figure 3–3. Switch Assembly of Cable Harness Assembly ARC-23042

3–3. TEST PROCEDURES.

Receiver Test. The alignment and testing of either an R-30 or R-30A Receiver as described in the ADF instruction book, may be performed with the BTK-21. Connect the receiver into the test set-up as shown in Figure 2–1. Construction of a radiating coil for loop amplifier alignment is not required as the RF field simulator performs this function. The loop may be rotated away from the null position to obtain the desired induced voltage.

Control Unit Test. To check the operation of either a C-59 or C-59A Control Unit, disconnect P1 of the cable harness assembly, reconnect it to J201 of the control unit, and check all control unit functions.

Power Unit Test. To test either a P-14 or P-14A Power Unit, connect it into the test set-up as shown in Figure 2–1. Through the use of the FREQUENCY METER, the frequency of the nominal 100-cps output may be checked. The two d-c voltage outputs may be checked by setting the METER SWITCH to the HV1 and HV2 positions and reading the VOLTMETER. The 100-cps output voltage may be checked by setting the METER SWITCH to the 100~ position and reading the VOLTMETER.

Indicator Test. To perform an operational check of the IN-12 Indicator, disconnect P3 from the ADF test panel and reconnect it to the IN-12 to be tested. Set the LOOP MOTOR ON-OFF switch to ON and the FAST-SLOW switch to SLOW. Check for friction by operating the LOOP switch to rotate the loop 360° to the right and then 360° to the left. The IN-12 should turn smoothly without any sudden jumps greater than 2°. If the loop in use has been compensated for some particular airplane, or if the compensating screws have been readjusted after leaving the factory, the IN-12 will rotate faster than the loop in some regions, and slower in others. For some compensations, the indicator pointer will seem to stop at more than one position.

To check directional rotation and accuracy, the indicator under test is compared with the ADF test panel indicator by alternately connecting P3 to the two indicators while setting the loop at various angles. After tapping, the indicators should be individually accurate to within 1¼°, so that the spread between indicator readings at any given point should not exceed 2½°.

To check the operation of an IN-13, proceed as for the IN-12, except disconnect P3 and connect P4 to the IN-13. P4 is wired so that both synchros in the IN-13 are paralleled, causing both needles to function at the same time.

The method for checking an IN-13A Indicator depends on the type of cable harness assembly used. When using Cable Harness Assembly ARC-23042, use the procedure outlined for an IN-12 Indicator, except disconnect P3 and connect P4 directly to the indicator. When using Cable Harness Assembly ARC-19790, use the procedure outlined for an IN-12, except disconnect P3 and connect Adapter Assembly ARC-22770 between P4 and the indicator. Adapter Assembly ARC-22770 is available on special order only.

Loop Compensation. The BTK-21 may be used to compensate the L-11 Loop if the error pattern of the aircraft is known. (Loop compensation procedures are outlined in the Type 21 and 21A instruction books.) Connect the loop as shown in Figure 2–1, but *do not install it in the RF field simulator.* Rotate the loop to the desired check points and adjust the appropriate compensator screw to provide the proper indicator reading.

System Tests. The performance of the Type 21 or 21A for COMP or LOOP operation may be checked with the BTK-21. Connect the equipment as shown in Figure 2–1; be sure the loop cable coupler is used. When the switch on the RF field simulator is in the FIELD position, the field strength, in microvolts/meter, at the loop and the simulated sense antenna is numerically equal to the signal generator output in microvolts. The REC output is fed from a simulated sense antenna of ¼-meter effective height and a capacitance of 50 $\mu\mu$f. In the DUMMY position, the REC output is connected directly to the signal generator through a 50-$\mu\mu$f dummy antenna. When the ADF is in COMP operation, the loop homes in on 0° as read on the L-11 Loop scale. When making loop sensitivity measurements, the loop must be preset to 90° or 270°.

SECTION IV
THEORY OF OPERATION

4–1. INTRODUCTION.

The ARC Type BTK-21 Bench Test Kit does not include any special electronic circuits. The equipment is prepared for its operational functions by the switching circuits included in the ADF test panel. The circuit connections resulting from the different switch positions are described in this section. Information regarding the RF field simulator, the loop cable coupler, and the cable assemblies is also included.

4–2. TEST PANEL, CONTROL SECTION.

General. The control section of the ADF test panel includes a function switch, identified as COMP-ANT-LOOP, a VOL control, a LOOP switch, a tuning crank, a tuning meter, a BAND switch, and a BFO switch. The frequency dial is displayed on a drum which provides equal dial lengths for all three bands. The BAND switch operates a masking drum which allows only the band in operation to be visible.

COMP Operation. With the COMP-ANT-LOOP switch in the COMP position, the circuit of the ADF test panel control section is connected as follows (see Figure 5–2):

The negative terminal of the tuning meter, M101, is grounded by S105. This grounds terminal P of J101 through M101. The receiver now operates at maximum r-f gain, the gain being controlled by avc action. The cathode current of the receiver r-f and first i-f amplifiers flows through the tuning meter. With no signal input to the receiver, M101 reads to the left. As the receiver input signal is increased the cathode current decreases due to avc, and since the zero current position is at the right, the meter reads farther to the right.

The low side of the VOL control, R101B, is grounded. R101B now acts an an audio level control.

Terminal B of J101 is grounded by S105.

The BAND switch, S102, grounds terminal F, G, or H of J101, as required to operate the receiver band switching motor.

LOOP switch, S104, permits connection of terminal K of J101 to either terminal L or terminal M of J101. When the LOOP switch is pressed either to the left or right, the loop antenna and the test panel indicators are rotated, independent of receiver signal.

The power on-off switch, S103, is part of the VOL control. This switch grounds terminal Q of J101 when the equipment is turned on, energizing the power relay in the P-14 (or P-14A).

ANT Operation. With the COMP-ANT-LOOP switch in the ANT position, the ADF test panel control section is connected as follows (see Figure 5–2):

Terminal R of J101 is grounded by S105. This removes the plate voltage from the receiver modulator circuit, deenergizing the loop circuits.

Tuning meter M101 is grounded through R101A, and the VOL control acts as an r-f sensitivity control. The tuning meter is affected by the setting of R101A, and M101 reads farther to the right as the VOL control is turned counterclockwise.

One end of the audio level control, R101B, is removed from ground. This causes the audio gain of the receiver to be near maximum at all times.

LOOP Operation. With the COMP-ANT-LOOP switch in the LOOP position, the ADF test panel control section is connected as described under ANT Operation, with one exception: terminal N of J101 is grounded by S105, energizing the loop relay in the R-30A Receiver.

Note

Loop functions are incorporated in the R-30A Receiver only.

BFO Operation. The BFO on-off switch, S101, grounds terminal I of J101 in the off position (switch closed). (See Figure 5–2.) With the voltage to transistor Q101 in the R-30A Receiver removed, the BFO is inoperative.

Note

The BFO is incorporated in the R-30A Receiver only.

4–3. TEST PANEL, TEST UNIT SECTION.

The test unit section of the ADF test panel includes ON-OFF and FAST-SLOW controls for the loop motor, GND and motor O2 jacks, a frequency meter, and an ac/dc meter and associated switch. (See Figure 5–2.) With S107, the LOOP MOTOR ON-OFF switch, in the ON position, terminals A and B of J102 are connected together through R102 placing R102 in series with the

loop motor and decreasing the speed of the loop motor. In the FAST position, S106 shunts R102, applying full voltage to the loop motor for normal operation.

The GND jack is connected to the common chassis ground of the ADF test panel. The O2 jack is connected to terminal B of J102 and provides a test point for measuring the 100-cps amplifier output that supplies O2 voltage of the loop motor.

A Frahm frequency meter, M102, is connected between terminal J of J102 and ground. This meter indicates the frequency of the dynamotor-alternator. Terminals J, K, L, M, R, and S of J102 are tied together.

The ac/dc meter, M103, and its associated switch, S108, operate as follows:

With S108 in the HV1 position, terminal H of J102 is connected to ground through multiplier-resistor R105, switch S108A, meter M103, and switch S108B. M103 now reads the value of HV1.

With S108 in the HV2 position, terminal G of J102 is connected to ground through multiplier-resistor R104, switch S108A, meter M103, and switch S108B. M103 now reads the value of HV2.

With S108 in the LV position, terminal F of J102 is connected to ground through multiplier-resistor R103, switch S108A, meter M103, and switch S108B. M103 now reads the value of LV.

With S108 in the TEL JKS position, terminal E is connected to M103 by switch S108C and meter-rectifier Z101. Terminal E is connected to the TEL jacks, J106 and J107. M103 now reads the a-c audio output voltage at the TEL jacks.

With S108 in the TEL 300ω position, terminal E is connected to M103 by S108C and Z101. Terminal E is connected to ground through R106. The TEL jacks are automatically disconnected by S108D, and M103 reads the audio output voltage across 300 ohms.

With S108 in the 100~ position, terminal J of J102 is connected to M103 through Z101 by S108C, and M103 reads the dynamotor-alternator 100~ output.

4–4. TEST PANEL, INDICATOR SECTION.

The indicator (M104) included in the ADF test panel is similar to an IN-12 Indicator. The indicator connections are terminated at J103 (see Figure 5–2). The indicator is electrically connected when P3 is inserted in J103.

4–5. RF FIELD SIMULATOR.

The RF field simulator acts as a combined loop-energizing field and dummy sense antenna, or as a dummy sense antenna alone. Its function depends on the position of the DUMMY-FIELD switch. A schematic diagram is shown in Figure 5–4.

With a signal generator connected to J101 and the DUMMY-FIELD switch, S101, in the FIELD position, C102 and C103 form a capacitive voltage divider. The sense antenna output voltage appears across C103 and is connected to J102. The voltage across C103 is one-fourth of the total voltage across the divider, in effect forming a 50-$\mu\mu$f sense antenna, ¼-meter in height. The field generating wire, because of its physical position in the box, and the terminating resistor R101, produce an r-f field suitable for energizing the loop. The r-f field is properly related in magnitude to the sense antenna voltage.

With S101 in the DUMMY position, J101 is connected to J102 through C101, forming a 50-$\mu\mu$f sense antenna only. The field generating wire is not connected to the signal generator and the loop antenna is not energized.

4–6. LOOP CABLE COUPLER.

A loss in loop inductance occurs when the loop is inserted in the RF field simulator. The loop cable coupler inserts an inductance of 1.5 μh in each leg of the balanced loop antenna to restore the lost inductance.

4–7. CABLE ASSEMBLIES.

Loop Cable Assembly ARC-17985 forms part of the loop antenna, and the built-in 350-$\mu\mu$f capacity keeps the loop input circuits in tune. The 100-$\mu\mu$f capacity built into Sense Antenna Cable Assembly ARC-17984 forms part of the receiver tuning circuit, and allows proper tuning and tracking of the receiver.

SECTION V
MAINTENANCE

5–1. INTRODUCTION.

No special maintenance procedures are required for the ARC Type BTK-21 Bench Test Kit. Preventive maintenance should be scheduled to minimize the possibility of breakdown (refer to paragraph 5–2). Figure 5–1 identifies the detail parts of the ADF test panel. Repair of the ADF test panel instruments is not recommended; defective units should be returned to the factory. Resistance, continuity, and substitution tests may be employed to localize trouble. Unit schematic and wiring diagrams, and cable fabrication diagrams are shown in Figures 5–2 through 5–11. The control section of the ADF test panel may be compared to a C-59 or C-59A Control Unit by removing P1 of the cable harness assembly from J101 and connecting it to the control unit. The indicator may be compared to an IN-12 Indicator by connecting P3 of the cable harness assembly to the IN-12.

5–2. PREVENTIVE MAINTENANCE.

Periodic preventive maintenance will promote trouble-free operation of the bench test kit. No special checks are required and no specific schedule is recommended. However, it is suggested that the following checks be included in the preventive maintenance program.

a. Check that all solder connections are mechanically and electrically secure.

b. Check that connector pins are not corroded or damaged. Damaged or deformed pins may cause intermittent operation.

c. Inspect the cables and the cable harness assembly for possible damage to the insulation or wires.

d. Check that meter glasses are not cracked or broken.

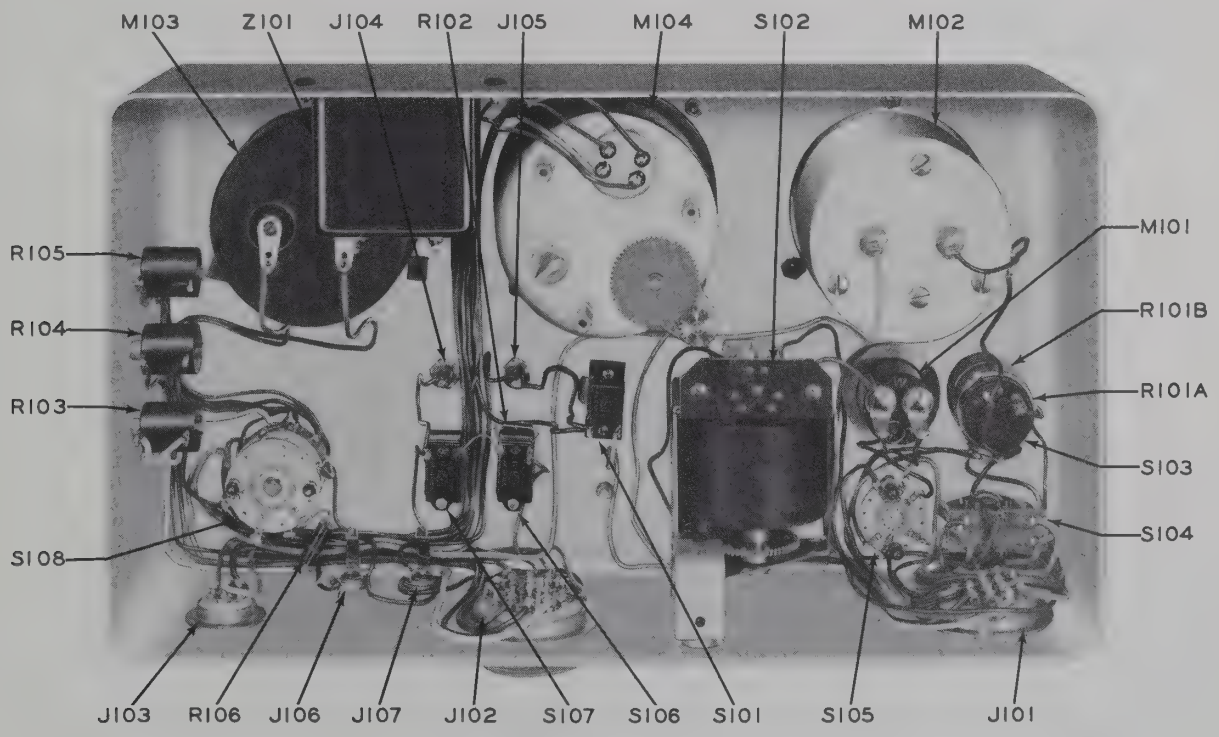
e. Check the calibration of the voltmeter to insure proper readings.

f. Inspect the RF field simulator for dents. A large dent may affect the r-f field pattern and cause improper operation of the loop antenna. Check the position and electrical connection of the field generating wire.

g. Panel markings should be legible. Keep the units free of dust, dirt, and grime.

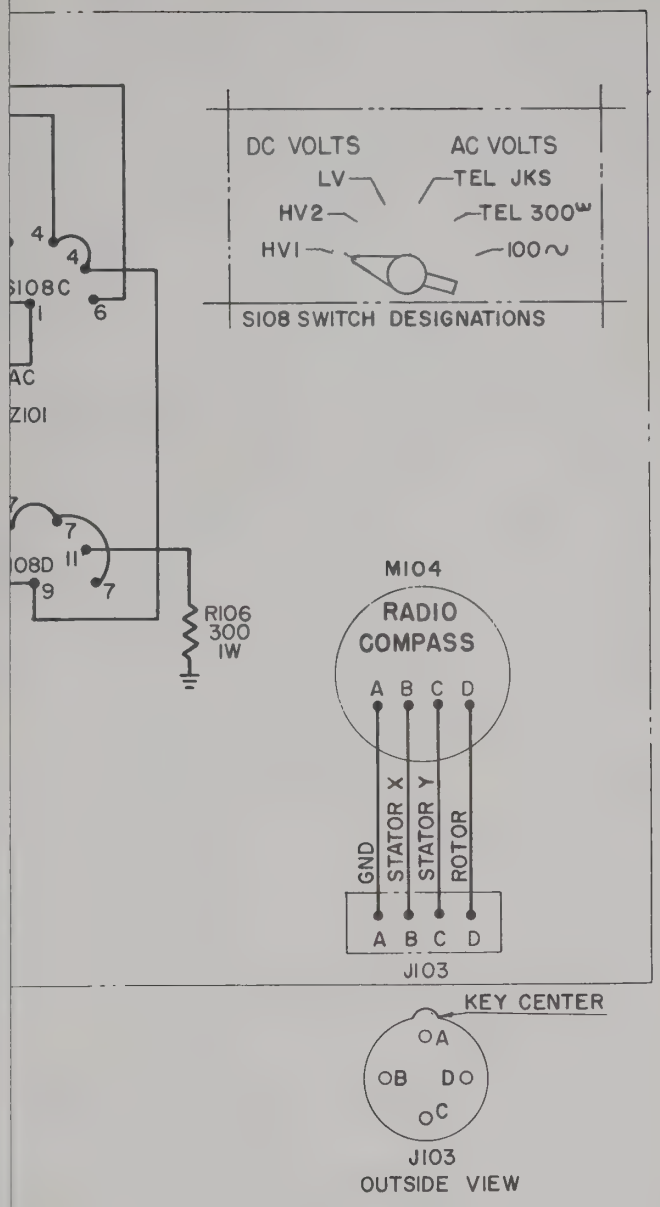
h. When necessary, lubricate the gearing of the tuning crank mechanism with a very light application of Esso Beacon No. 325 grease, or equivalent.

i. Clean METER SWITCH contacts with a dry-cleaning solvent such as Esso Varsol or Federal Specification P-S-661.

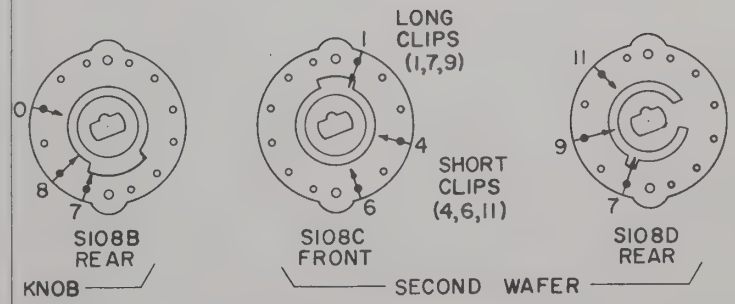


TP1340

Figure 5–1. ADF Test Panel, Rear Interior View



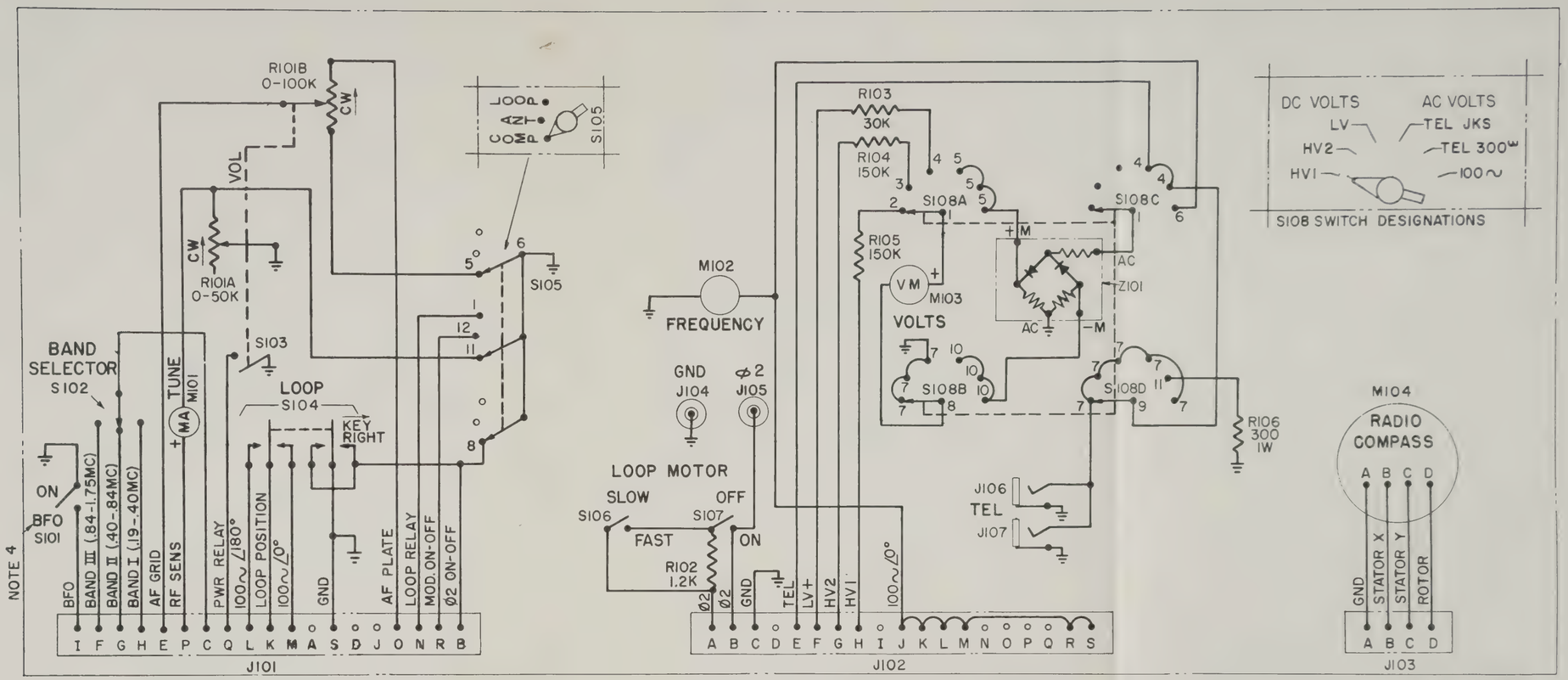
CH DETAIL

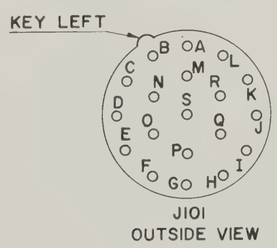


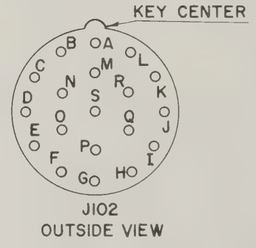
D FROM KNOB ENDS OF SWITCHES WITH SHAFTS
POSITIONS.

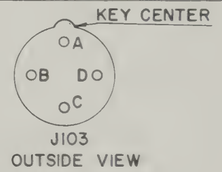
19772D

Figure 5–2. ADF Test Panel, Schematic Diagram





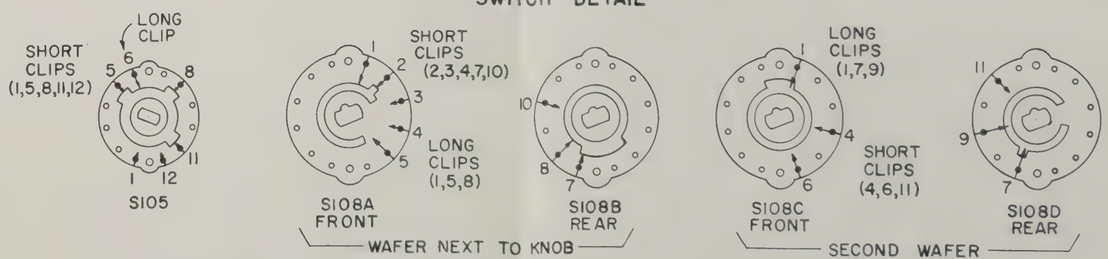




NOTES:

1. FOR WIRING DIAGRAM SEE FIGURE 5-3.
2. RESISTOR VALUES ARE IN OHMS. MULTIPLIER: K=1,000.
3. SWITCH SECTIONS ARE VIEWED FROM KNOB END.
4. BFO SWITCH OPERATION: ON=SWITCH OPEN; OFF=SWITCH CLOSED.
5. FOR CLARITY, S105 IS SHOWN SCHEMATICALLY AS THREE 3-CONTACT SECTIONS AND S108 AS FOUR 6-CONTACT SECTIONS. ACTUAL SWITCH SECTIONS ARE AS SHOWN IN "SWITCH DETAIL."
6. Ø1 (PHASE 1) IS REFERENCE PHASE OF LOOP DRIVE MOTOR; Ø2 (PHASE 2) IS CONTROL PHASE, ±90° FROM Ø1.

SWITCH DETAIL



CONTACT ARRANGEMENTS VIEWED FROM KNOB ENDS OF SWITCHES WITH SHAFTS IN EXTREME COUNTERCLOCKWISE POSITIONS.

19772D

Figure 5—2. ADF Test Panel, Schematic Diagram

NOTES:
1. FOR SCHEMATIC DIAGRAM SEE FIGURE
2. WIRES MARKED WITH COLOR NOTE ARE TINNED COPPER, VINYLITE INSULATED
3. UNMARKED WIRES ARE #22 BARE, SOLI TINNED COPPER.

SYMBOL IDENTIFICATION TABLE

MULTIPLIER: K=1,000		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
J101	12357	RECEPTACLE
J102	12096	RECEPTACLE
J103	12425	RECEPTACLE
J104	8803(BLK)	TEST JACK
J105	8803(D. GRN)	TEST JACK
J106	7565	JACK
J107	7565	JACK
M101	18428	TUNING METE
M102	19749	FREQUENCY ME
M103	19992	VOLTMETER
M104	19985	INDICATOR
R101A	8776	0-50K VARIABL
R101B		0-100K VARIABI
R102	201	1.2K OHMS
R103	8858	30K OHMS
R104	8859	150K OHMS
R105	8859	150K OHMS
R106	202	300 OHMS
S101	8084	SWITCH (SPST
S102	PART OF 18639	SWITCH
S103	PART OF 8776	SWITCH (SPST
S104	20452	SWITCH (DPDT
S105	19982	SWITCH, ROTA
S106	8084	SWITCH (SPST
S107	8084	SWITCH (SPST
S108A-D	19981	SWITCH, ROTA
Z101	19993	RECTIFIER

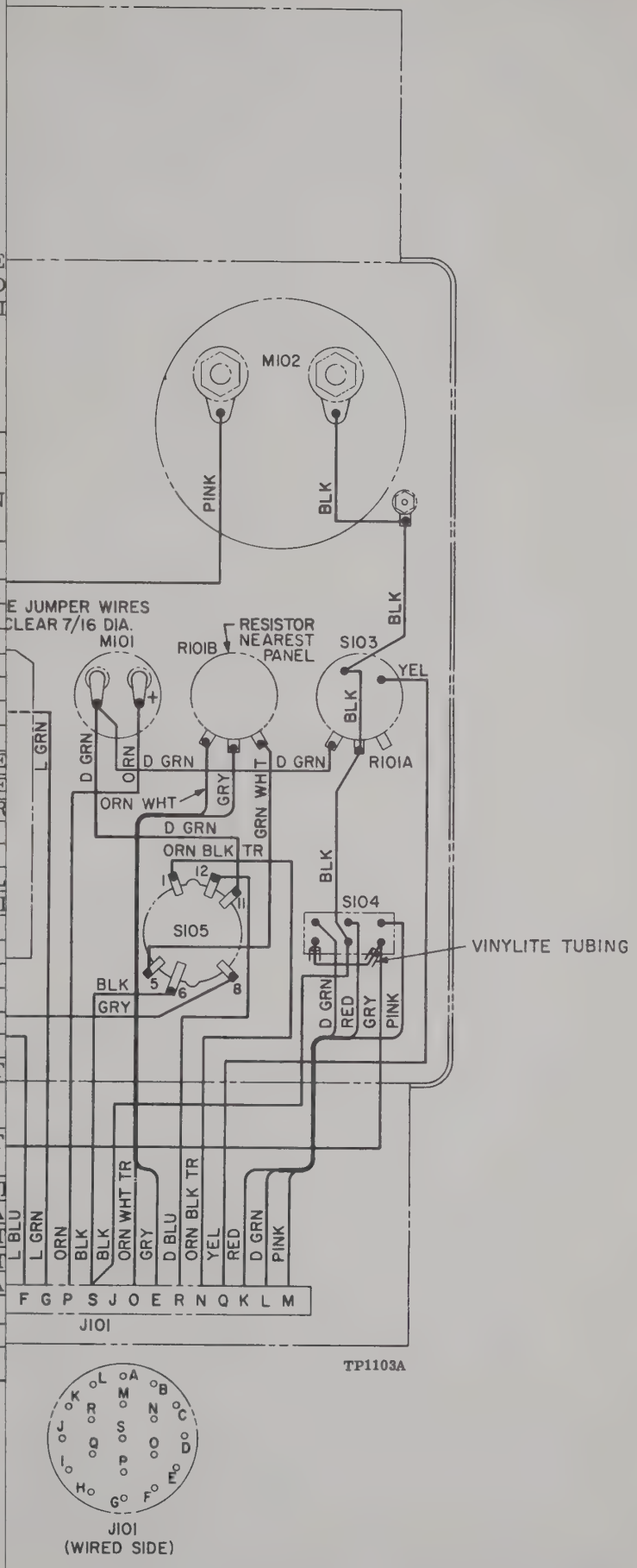


Figure 5—3. ADF Test Panel, Wiring Diagram

NOTES:
1. FOR SCHEMATIC DIAGRAM SEE FIGURE 5-2.
2. WIRES MARKED WITH COLOR NOTE ARE #22 SOLID, TINNED COPPER, VINYLITE INSULATED.
3. UNMARKED WIRES ARE #22 BARE, SOLID, TINNED COPPER.

SYMBOL IDENTIFICATION TABLE

MULTIPLIER: K=1,000		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
J101	12357	RECEPTACLE
J102	12096	RECEPTACLE
J103	12425	RECEPTACLE
J104	8803(BLK)	TEST JACK
J105	8803(D. GRN)	TEST JACK
J106	7565	JACK
J107	7565	JACK
M101	18428	TUNING METER
M102	19749	FREQUENCY METER
M103	19992	VOLTMETER
M104	19985	INDICATOR
R101A	8776	0-50K VARIABLE
R101B		0-100K VARIABLE
R102	201	1.2K OHMS
R103	8858	30K OHMS
R104	8859	150K OHMS
R105	8859	150K OHMS
R106	202	300 OHMS
S101	8084	SWITCH (SPST)
S102	PART OF 18639	SWITCH
S103	PART OF 8776	SWITCH (SPST)
S104	20452	SWITCH (DPDT)
S105	19982	SWITCH, ROTARY
S106	8084	SWITCH (SPST)
S107	8084	SWITCH (SPST)
S108A-D	19981	SWITCH, ROTARY
Z101	19993	RECTIFIER

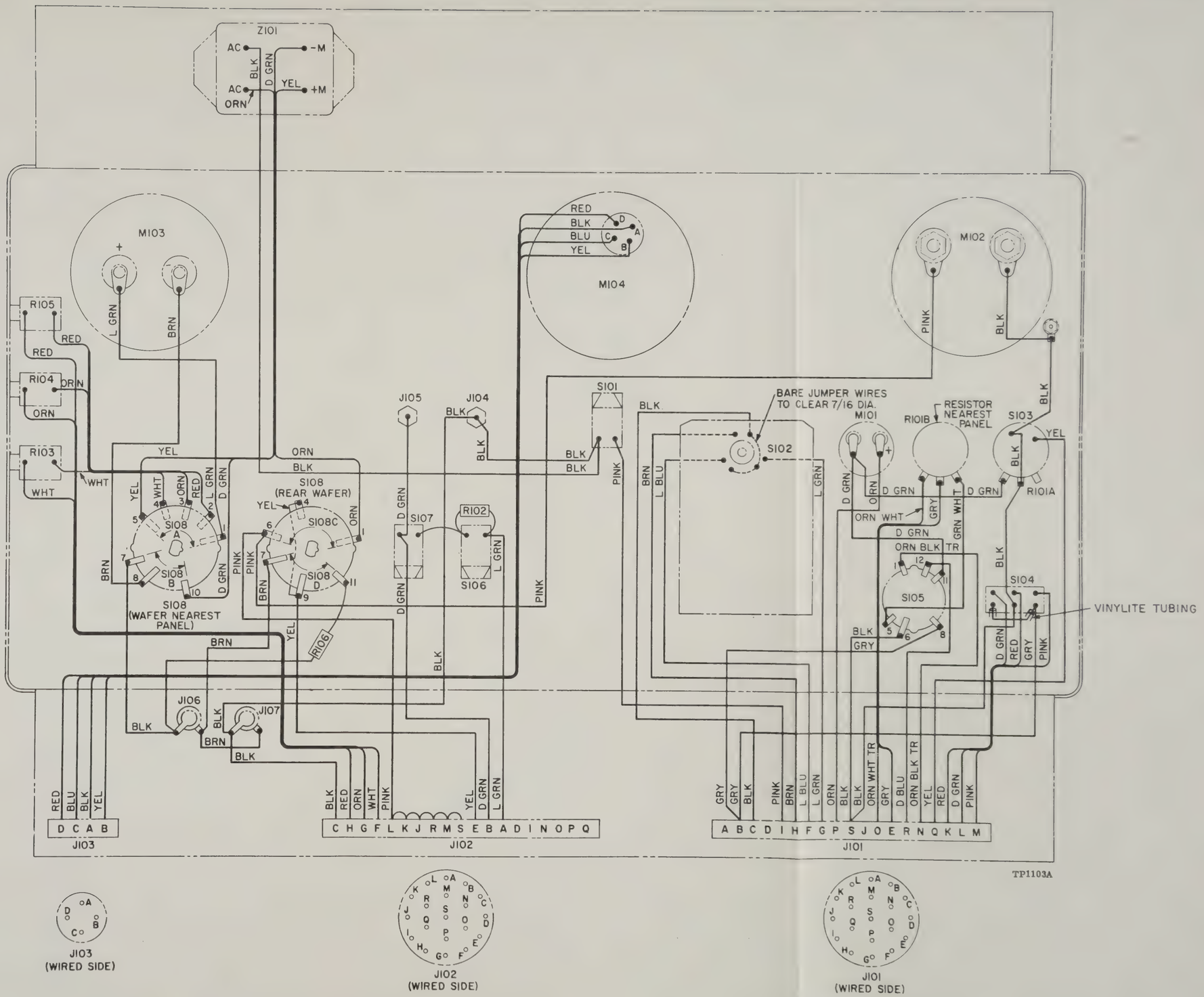


Figure 5–3. ADF Test Panel, Wiring Diagram

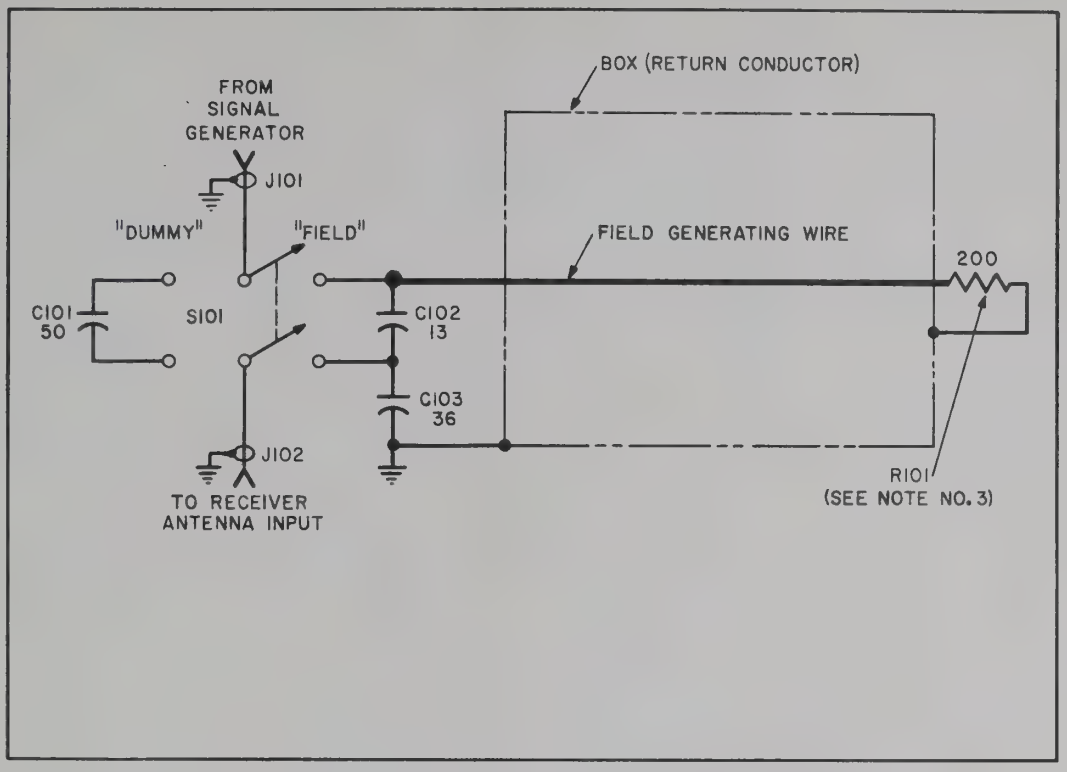


Figure 5–4. RF Field Simulator, Schematic Diagram

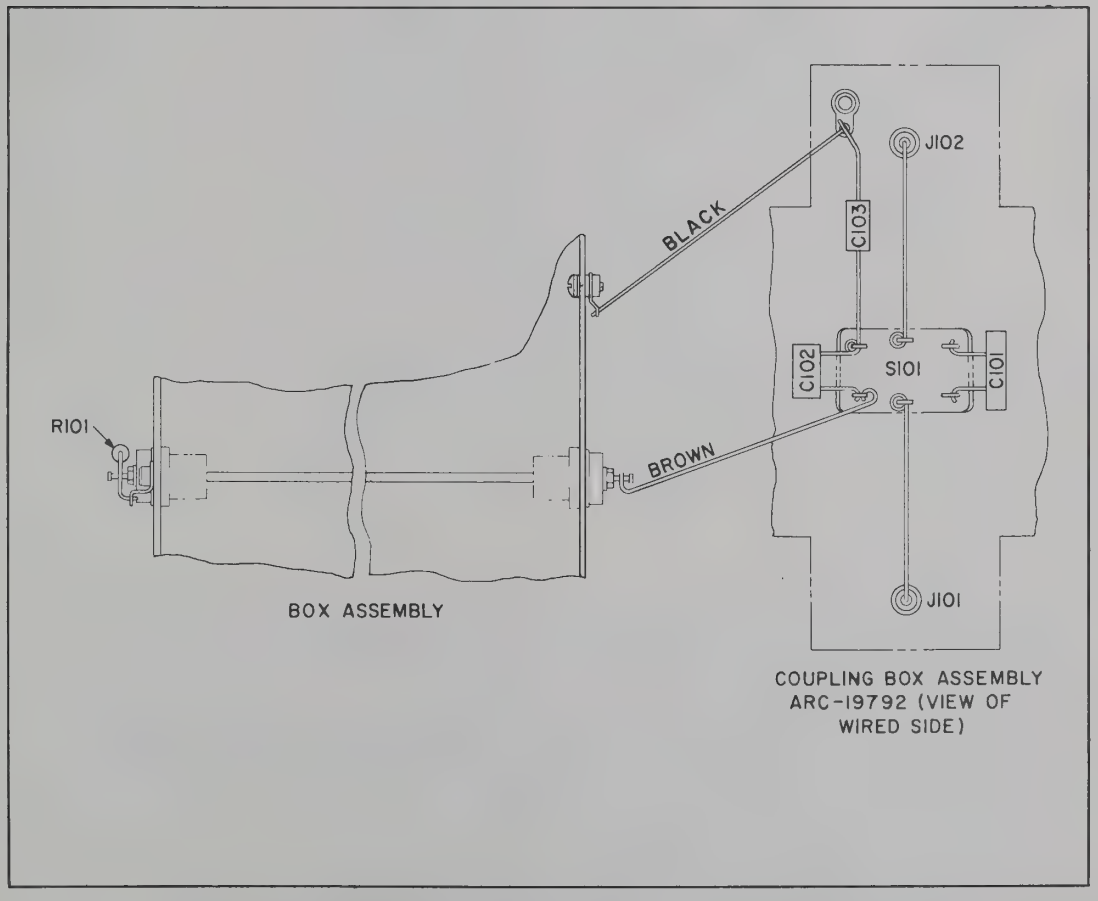


Figure 5–5. RF Field Simulator, Wiring Diagram

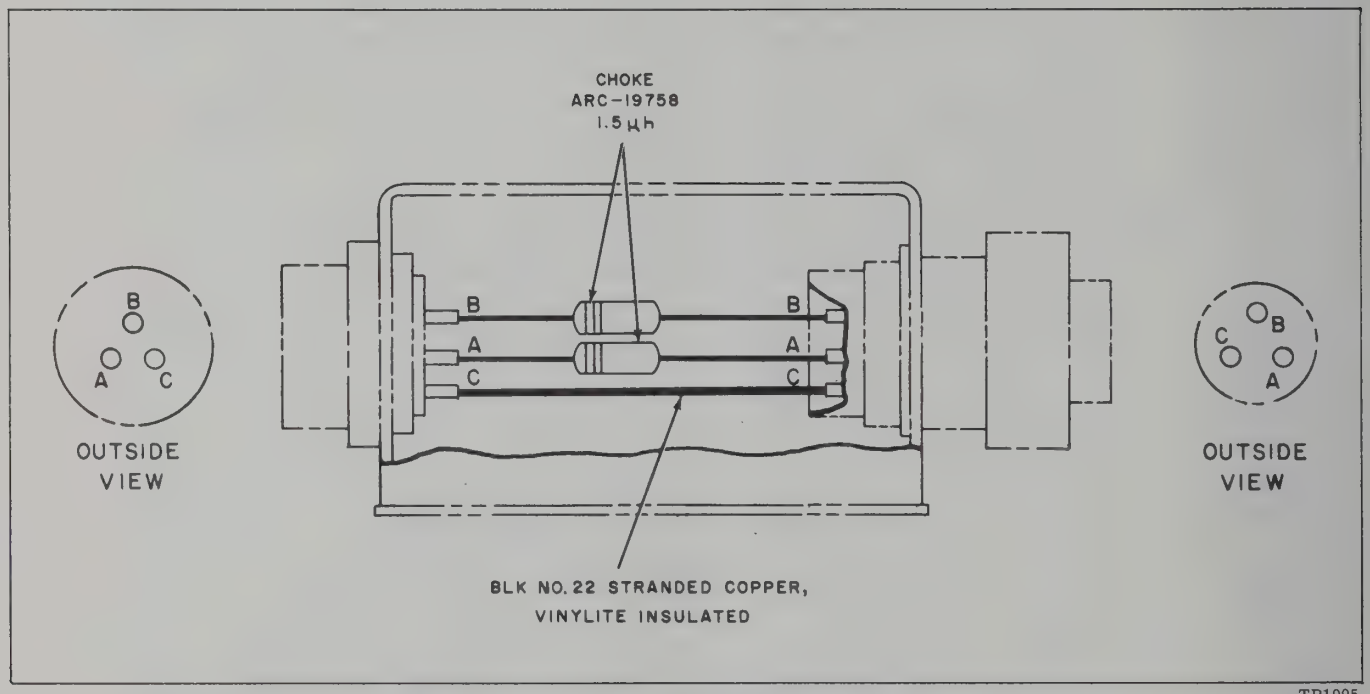
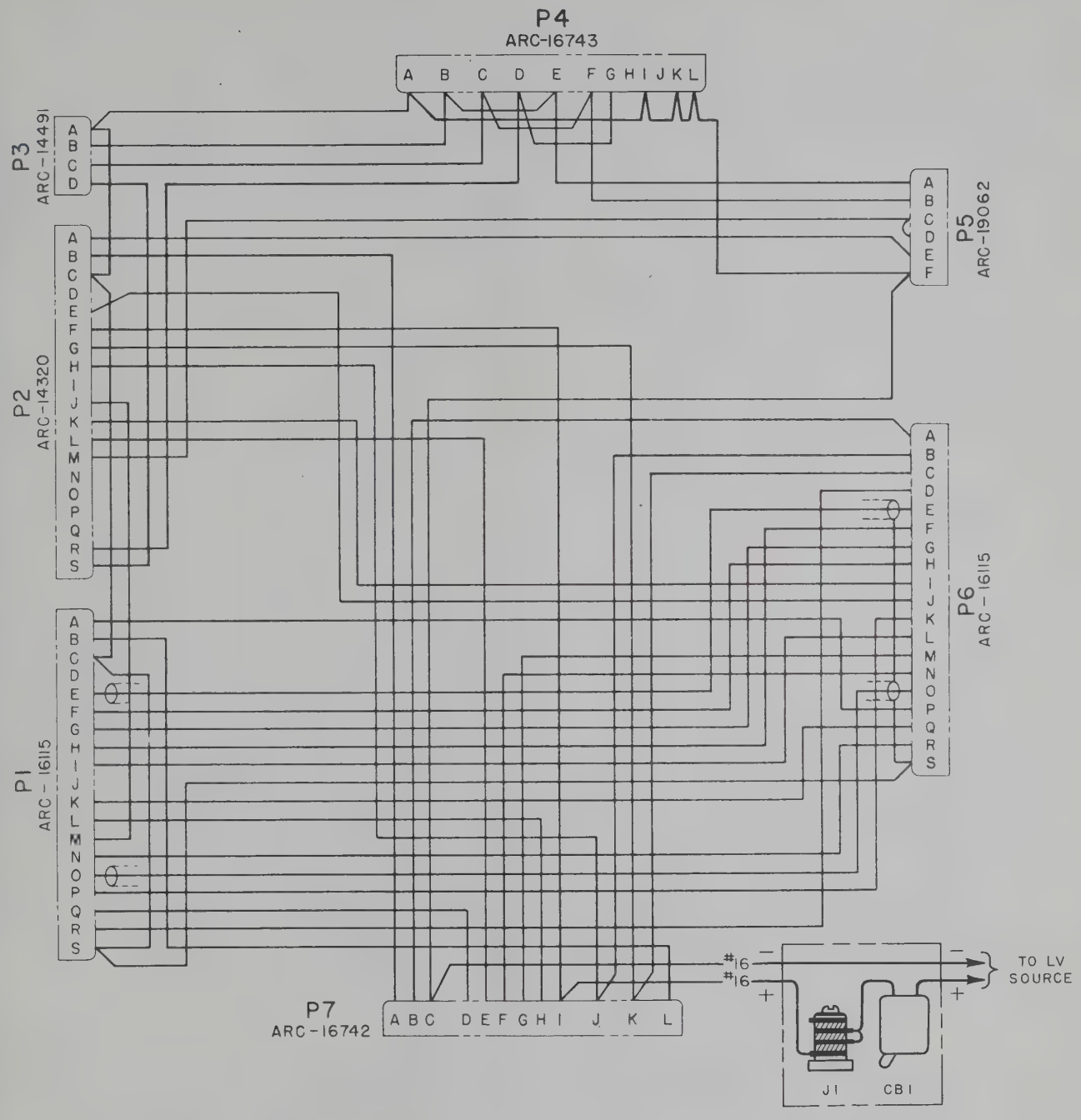


Figure 5–6. Loop Cable Coupler, Wiring Diagram

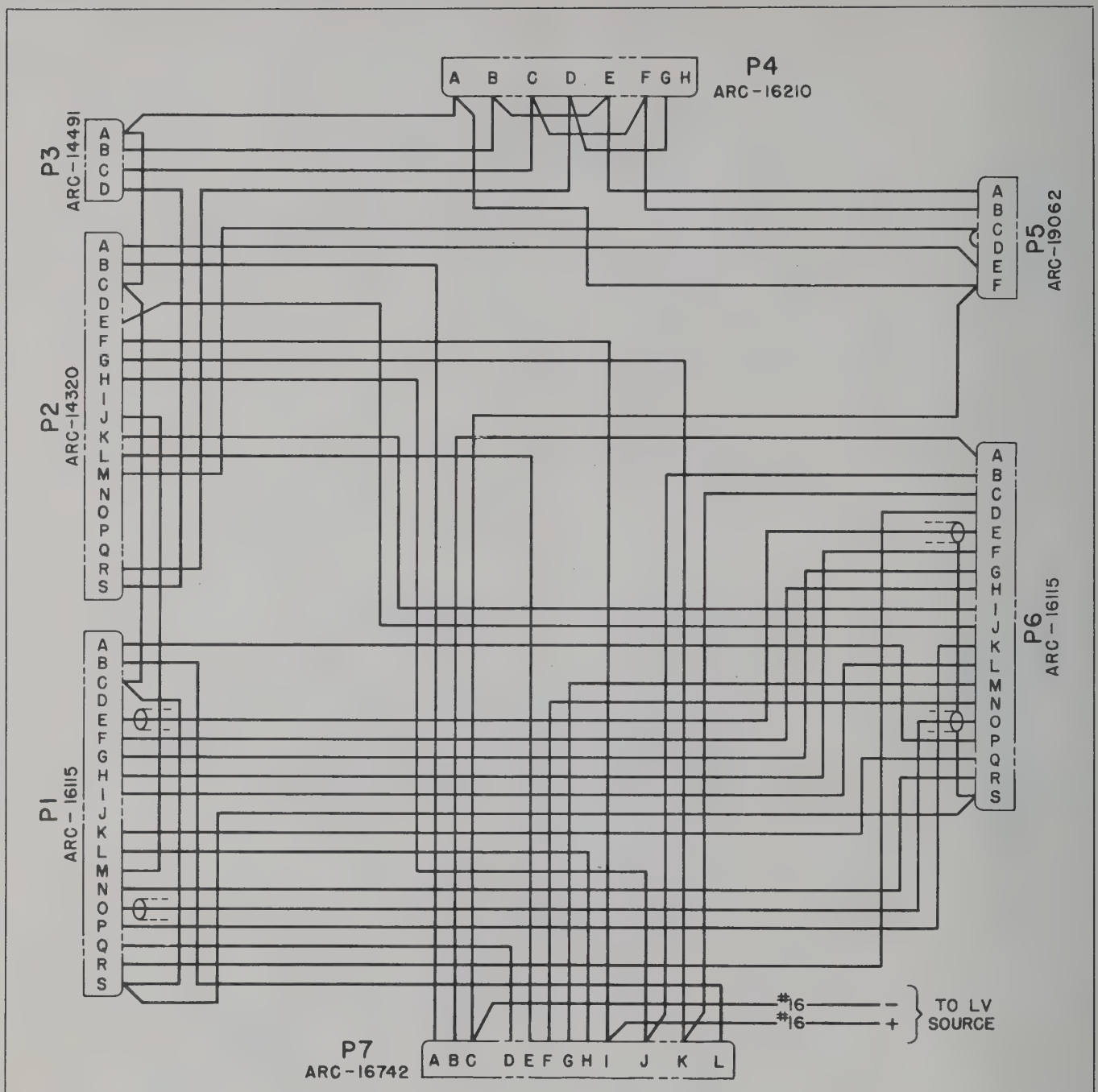


NOTES:

1. WIRES INDICATED BY ⊣⊢ ARE #22 STRANDED COPPER, POLYVINYL INSULATION, BRAIDED COPPER SHIELD. SHIELDS ARE CONNECTED AS INDICATED. FIBERGLAS TUBING IS USED OVER ENDS OF BRAID AND WIRE TO PREVENT SHORTING IN PLUG NO. 5.
2. WIRES MARKED #16 ARE #16 STRANDED COPPER, PRIMARY INSULATION, FIBROUS GLASS BRAIDING, OUTER PROTECTIVE COATING.
3. OTHER WIRES ARE #22 STRANDED COPPER, PRIMARY INSULATION, FIBROUS GLASS BRAIDING, OUTER PROTECTIVE COATING.

TP1669

Figure 5–7. Cable Harness Assembly ARC-23042, Wiring Diagram

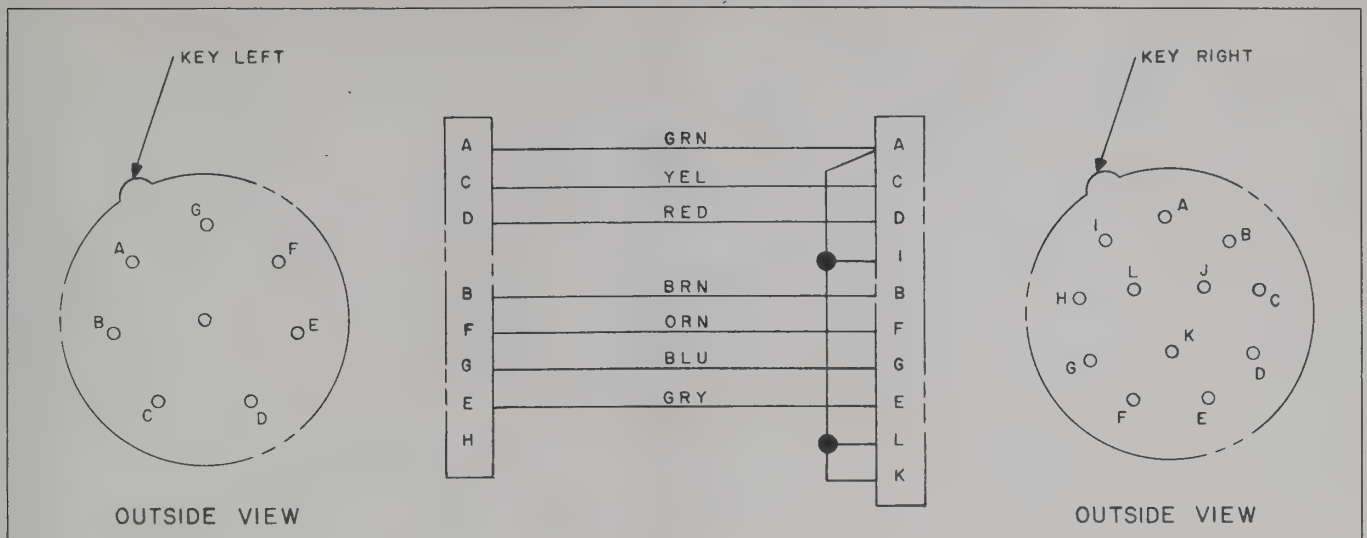


NOTES:

1. WIRES INDICATED BY ⫐ ARE #22 STRANDED COPPER, POLYVINYL INSULATION, BRAIDED COPPER SHIELD. SHIELDS ARE CONNECTED AS INDICATED. FIBERGLAS TUBING IS USED OVER ENDS OF BRAID AND WIRE TO PREVENT SHORTING IN PLUG NO. 5.
2. WIRES MARKED #16 ARE #16 STRANDED COPPER, PRIMARY INSULATION, FIBROUS GLASS BRAIDING, OUTER PROTECTIVE COATING.
3. OTHER WIRES ARE #22 STRANDED COPPER, PRIMARY INSULATION, FIBROUS GLASS BRAIDING, OUTER PROTECTIVE COATING.

TP1097

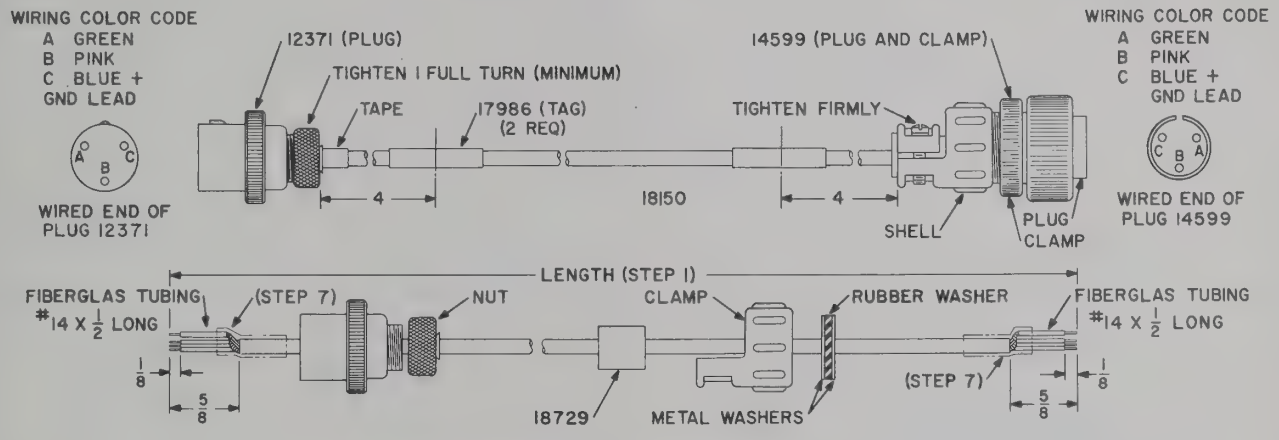
Figure 5–8. Cable Harness Assembly ARC-19790, Wiring Diagram



NOTES:
1. WIRES ARE #22 STRANDED, INSULATED COPPER.
2. JUMPER WIRES ARE #22 SOLID, BARE, TINNED COPPER.

22771A

Figure 5–9. Adapter Assembly, Wiring Diagram



ASSEMBLY PROCEDURE

1. CUT CABLE LENGTH SO THAT THE EFFECTIVE CAPACITY BETWEEN A AND B WITH C CONNECTED TO SHIELD IS 350 $\mu\mu$F, $\pm^{0}_{5}$ $\mu\mu$F (APPROXIMATELY 22 FEET).
2. INSERT CABLE THROUGH 18729; CLAMP, WASHERS, SHELL, AND NUT OF 14599; AND NUT AND SHELL OF 12371.
3. REMOVE 5/8'' OF OUTER JACKET FROM CABLE ENDS.
4. BRING OUT CONDUCTORS THROUGH HOLE IN BRAID AT END OF OUTER JACKET, AND FORM BRAID INTO A GROUND LEAD OF MINIMUM WIDTH.
5. STRIP CONDUCTORS. CUT GROUND LEAD TO LENGTH SHOWN. TIN CONDUCTORS AND GROUND LEAD.
6. INSULATE GROUND LEAD WITH TUBING AND SOLDER CONDUCTORS AND GROUND LEAD TO TERMINALS.
7. WRAP 6 TURNS OF BLACK, PRESSURE-SENSITIVE, ELECTRICAL TAPE, 3/4-INCH WIDE, AT 12371 END, AROUND CABLE COUNTERCLOCKWISE (LOOKING AT END OF CABLE) WITH 2/3 OF ITS WIDTH COVERING OUTER JACKET. WRAP 1-1/2 TURNS SIMILARLY AT 14599 END.
8. ASSEMBLE PLUG PARTS TO INSULATORS. TIGHTEN SHELL AND CLAMP OF PLUG 14599 FIRMLY. TIGHTEN NUT OF PLUG 12371 AT LEAST ONE FULL TURN.

TP1099

Figure 5–10. Loop Cable Assembly, Fabrication Diagram

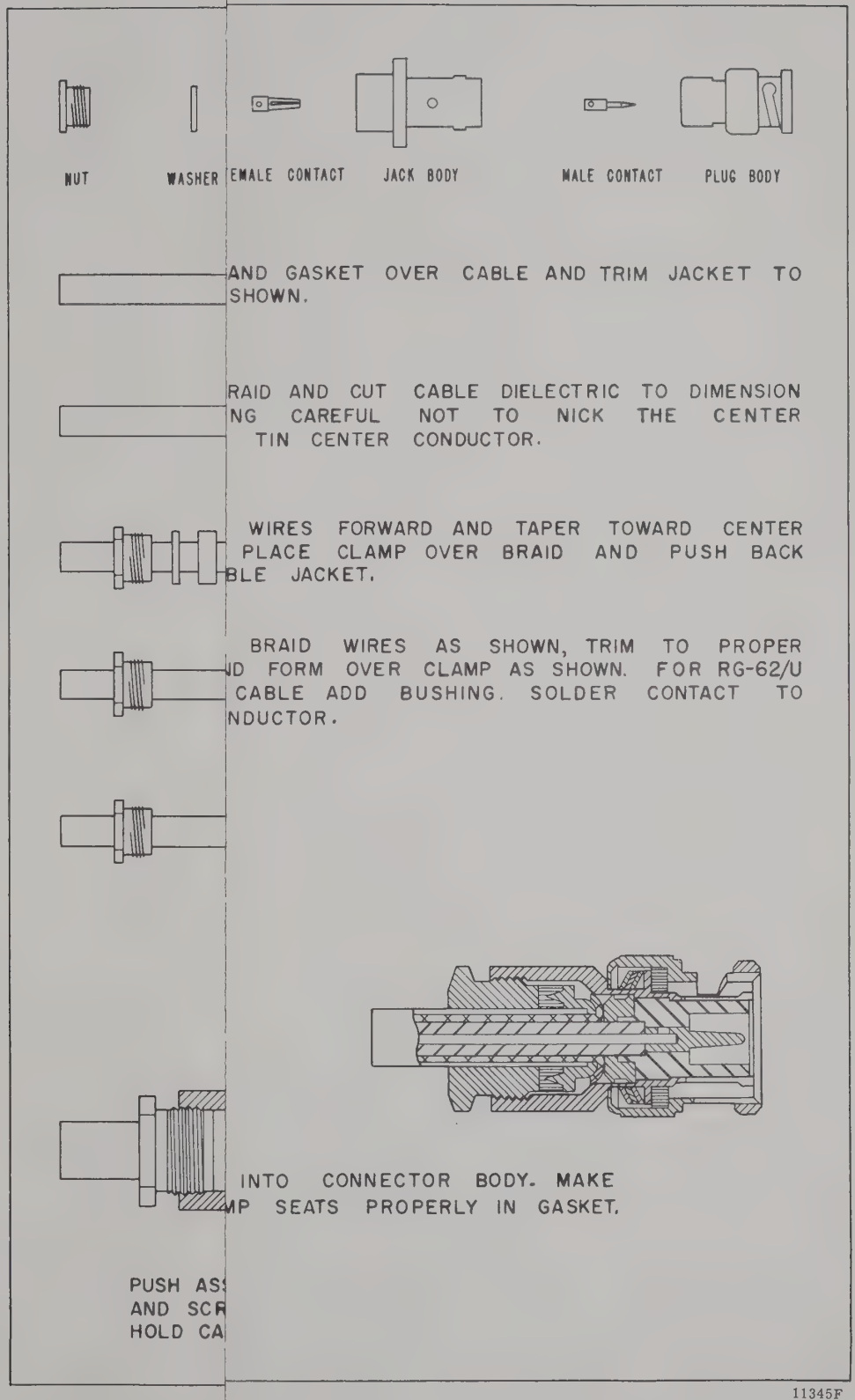
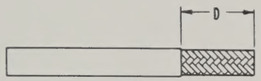
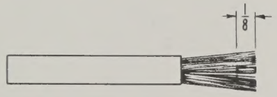


Figure 5–11. Sense Antenna Cable Assembly, Fabrication Diagram

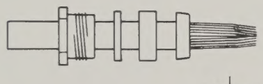
ASSEMBLY INSTRUCTIONS FOR SERIES BNC CONNECTORS



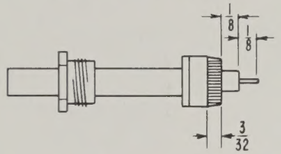
TRIM JACKET:
D = 1/4 FOR RG-58/U
D = 5/16 FOR RG-59/U
D = 7/16 FOR RG-71/U



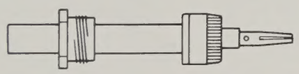
COMB OUT BRAID AND CUT CABLE DIELECTRIC TO DIMENSION SHOWN BEING CAREFUL NOT TO NICK THE CENTER CONDUCTOR. TIN CENTER CONDUCTOR.



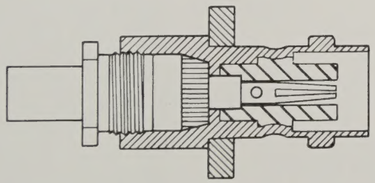
TAPER BRAID AND SLIDE NUT, WASHER, GASKET AND CLAMP OVER BRAID. CLAMP IS INSERTED SO THAT ITS INNER SHOULDER FITS SQUARELY AGAINST END OF CABLE JACKET.

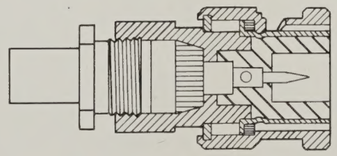


WITH CLAMP IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN AND TRIM 3/32" FROM END.



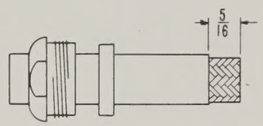
SLIP CONTACT IN PLACE, BUTT AGAINST DIELECTRIC AND SOLDER. REMOVE EXCESS SOLDER FROM OUTSIDE OF CONTACT. BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC FROM ENTERING INTO CONNECTOR BODY.



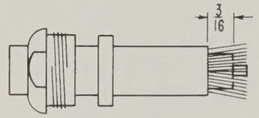


PUSH ASSEMBLY INTO BODY AS FAR AS IT WILL GO. SLIDE NUT INTO BODY AND SCREW IN PLACE WITH WRENCH UNTIL TIGHT. FOR THIS OPERATION, HOLD CABLE AND SHELL RIGID AND ROTATE NUT.

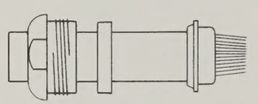
ASSEMBLY INSTRUCTIONS FOR IMPROVED SERIES BNC CONNECTORS



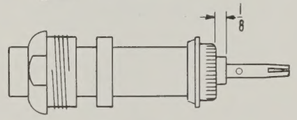
PLACE NUT AND GASKET OVER CABLE AND TRIM JACKET TO DIMENSION SHOWN.



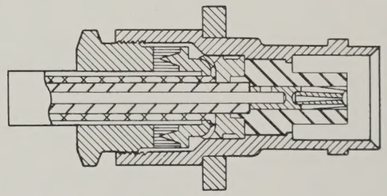
COMB OUT BRAID AND CUT CABLE DIELECTRIC TO DIMENSION SHOWN BEING CAREFUL NOT TO NICK THE CENTER CONDUCTOR. TIN CENTER CONDUCTOR.

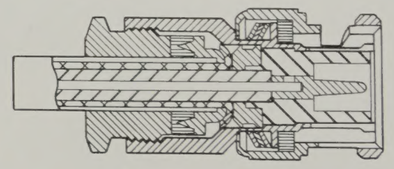


PULL BRAID WIRES FORWARD AND TAPER TOWARD CENTER CONDUCTOR. PLACE CLAMP OVER BRAID AND PUSH BACK AGAINST CABLE JACKET.



FOLD BACK BRAID WIRES AS SHOWN, TRIM TO PROPER LENGTH AND FORM OVER CLAMP AS SHOWN. FOR RG-62/U AND RG-71/U CABLE ADD BUSHING. SOLDER CONTACT TO CENTER CONDUCTOR.





INSERT CABLE AND PARTS INTO CONNECTOR BODY. MAKE SURE SHARP EDGE OF CLAMP SEATS PROPERLY IN GASKET. TIGHTEN NUT.

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Figure 5–11. Sense Antenna Cable Assembly, Fabrication Diagram

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